

# Dr. Maxie Dion Schmidt

## Mathematician and Software Engineer

### Curriculum Vita – Resume – Revised August 27, 2023

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💬 Please send email to accompany phone calls to contact me  
💬 Professional references are available upon request

## Education

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|---|----------------------|
| <b>Georgia Institute of Technology</b><br><i>Doctor of Philosophy in the School of Mathematics</i>  | <b>Ph.D.</b><br>2022 |
| <b>University of Illinois at Urbana-Champaign</b><br><i>Master of Science in Computer Science</i>   | <b>M.S.</b><br>2014  |
| <b>University of Illinois at Urbana-Champaign</b><br><i>Bachelor of Science in Liberal Arts and Science for Math and in Engineering for Computer Science</i><br>Distinctions include receiving the first Barry M. Goldwater scholarship in computer science department history as a woman in 2010 | <b>B.S.</b><br>2012  |
| <b>Northwest Missouri State University</b><br><i>Missouri Academy of Science, Mathematics and Computing</i>   | <b>A.S.</b><br>2004  |

## Employment

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| <b>Sandia National Labs</b><br><i>R&amp;D Computer Science researcher for the Honeywell US/DoE subsidiary division in Albuquerque</i>  | 2022      |
| <b>Graduate Research Assistant and Software Engineer at Georgia Tech</b><br><i>Mathematical Biology Group Research Assistant and Software Engineer Roles</i><br>More than three years with the <i>Georgia Tech Discrete Mathematics and Molecular Biology</i> (gtDMMB) research group. Recent work with the group and their growing list of software contributions includes updating, growing, and debugging the existing mathematical visualization code for the <i>RNAStructViz</i> application.   | 2018–2022 |
| <b>Graduate Research Assistant and Software Engineer at Georgia Tech</b><br><i>NFC-Related open source software through university COVID-19 relief funding grants</i>  | 2022      |
| <b>Instructor of Record at Georgia Tech</b><br><i>Course instructor of Integral Calculus for the summer 2021 semester</i>  | 2021      |
| <b>Graduate Teaching Assistant at Georgia Tech</b><br><i>Roles include: Head TA for Integral Calculus and course grader for combinatorics courses</i>  | 2017–2021 |
| <b>Freelance Software Engineer</b><br><i>C and C++, Java, and Android OS application and library development</i><br>Projects involved creating cryptographic routines and customizing the Chameleon Mini RevG firmware sources in C and C++ for custom private commercial NFC applications.  | 2018–2019 |
| <b>Computational consultant and online instructor with the University of Washington</b><br><i>Research assistant focused on undergraduate mentorship and experimental math projects</i><br>Remote computational data consultant work, programming, and webserver administration for tiling, geometry, and graph-theoretic projects with the University of Washington in Seattle. Served as an online instructor to teach a junior-level honors mathematics course focused on graphical visualization and exploration of geometric tilings of the plane in Python with an emphasis on software methodology. | 2016–2017 |
| <b>Graduate teaching assistant at the University of Washington in Seattle</b><br><i>Two quarters as a teaching assistant for Calculus II in the department of mathematics</i>  | 2014–2015 |
| <b>Illinois Geometry Lab Programming Consultant</b><br><i>Volunteer programming consultant at the University of Illinois at Urbana-Champaign</i><br>Involvement in Mathematica and Python related projects within the <i>Illinois Geometry Lab</i> (IGL) in the mathematics department. The projects in the IGL were focused on mathematical visualization and community engagement.   | 2013–2014 |
| <b>Graduate Teaching Assistant at the University of Illinois at Urbana-Champaign</b><br><i>Four semesters as a teaching assistant for Discrete Structures (CS173)</i>  | 2012–2014 |

# Software

## Experience and Computer Programming Skills

- Experience with C and C++, Python, microcontroller and ATmega firmware programming, Java, shell and cmake build scripts, Mathematica, Sage, and LaTeX typesetting.
- Software development on Linux and Mac OSX including package installation via *Homebrew*.
- Development of Android applications and libraries focusing on NFC, USB interfacing to the Chameleon Mini penetration testing device, audio and video recording, and NFC tag recognition libraries.
- Administration and systems programming for a variety of Linux and Unix-like platforms including desktop maintenance, server administration, and building custom home routers using *OpenBSD*.

## STEM Supportive Educational Open Source Software

- **GTfold Python:** Python bindings and library to modernize and extend for the historical set of *GTfold* command line utilities for use with Python. It is a scientific computing project to facilitate experimentation with RNA structures in computational biology.  
🌐 <https://github.com/gtDMMB/GTFoldPython/wiki>
- **Mathematical Unix Fortune Mod:** A math-related add-on package providing terminal-based text in the form of Unix fortune cookie wisdom and a custom *Concrete Math* book style upper case  $\Sigma$  summation text graphic.  
🌐 <https://github.com/maxieds/math-fortune-mod>
- **Mertens Function Manuscript Computational Supplement:** Facilitates computations with the Mertens function in both *SageMath* and *Mathematica*.  
🌐 <https://github.com/maxieds/MertensFunctionComputations>
- **OptiKey “Big Hacker” Keyboard Extensions:** Open source code and documentation that makes typing programming languages on-screen for users with disabilities more accessible. These “big hacker” encoded keyboards are designed to simplify on-screen entry of programming languages, a task which otherwise requires scrolling through multiple cell-phone-type keyboard screens to enter a single line of code or even language statement literals in C++, Perl or Python.  
🌐 <https://github.com/maxieds/OptiKey/blob/master/README.md>  
🌐 <https://github.com/maxieds/OptiKey/tree/master/keymaps>  
🌐 <https://github.com/OptiKey/OptiKey/blob/master/src/JuliusSweetland.OptiKey.Core/Resources/Keyboards/BigHackerKeyboard.xml>
- **Partitions Into Parts Package:** An extendable and expository Mathematica demo package for computing the number of partitions of a positive integer  $n$  into parts of the form  $pt + a$  for  $p$  prime and  $0 \leq a < p$ .  
🌐 <https://github.com/maxieds/PartitionsIntoParts>
- **Prairie Learn Contributor:** Prairie Learn is an option to replace *Canvas* at many universities that is actively developed at UBC and UIUC and is used on a private server form at UC Berkeley. I have so far contributed code to enable custom function names, symbolic constants, custom-defined operator symbols, and documentation available for use with sympy Python library parsing of internal pl-symbolic-input elements. This pull request enables crucial parsing for questions in calculus, mathematics and physics by enabling custom function names and symbolic constants like  $\ln$ ,  $\sec$ ,  $\operatorname{atanh}$ , and  $\zeta$  among others.  
🌐 <https://github.com/PrairieLearn/PrairieLearn>
- **RNAstructViz:** A cross-platform GUI-based application to visualize and compare RNA secondary structures.  
🌐 <https://github.com/gtDMMB/RNAstructViz/wiki>
- **Sage and Mathematica Special Sequence Formula Guess Packages:** UIUC MS thesis software in both Mathematica (original) and Sage (extended). It is designed to guess formulas for special input sequences.  
🌐 <https://arxiv.org/abs/1609.07301>  
🌐 <https://github.com/maxieds/GuessPolynomialSequences>  
🌐 <https://github.com/maxieds/sage-guess>
- **WXML Tilings Python Library:** I was offered an unforgettable opportunity in 2016–2017 to take part in mentoring advanced undergraduates in mathematics by teaching a self-created topics course remotely with the University of Washington. The course outline focused on getting students hands-on experience with experimental mathematics methodology, gap distributions and spatial statistics and visualizing substitution tilings of the plane in the Python programming language.  
🌐 <https://github.com/maxieds/WXMLTilingsHOWTO/wiki>

## Free Software Contributions

- **Android File Picker Light Library:** A file and directory chooser widget library for Android OS that focuses on presenting an easy to configure lightweight UI. Designed to work with newer Android 10 and 11 (API 29+) platforms in the future.  
🌐 <https://github.com/maxieds/AndroidFilePickerLight>
- **Chameleon Mini Crypto Modified Firmware Extension:** A modification of the stock Chameleon Mini firmware sources to enable cryptographically secure and integrity checked binary data uploads onto the device.  
🌐 <https://github.com/maxieds/ChameleonCryptoModFirmware>
- **Chameleon Mini Live Debugger:** The application is a portable interactive NFC debugging and logging tool for Android OS phones that interfaces to the Chameleon Mini RevG hardware over USB.  
🌐 <https://github.com/maxieds/ChameleonMiniLiveDebugger/wiki>  
🌐 <https://play.google.com/store/apps/details?id=com.maxieds.chameleonminilivedebugger>

- 🌐 <https://play.google.com/store/apps/details?id=com.maxieds.chameleonminilivedebugger.paid>
- **DESFire Emulation Support for the Chameleon Mini:** The Chameleon Mini is a hardware tool for NFC debugging, card emulation, security testing, reconnaissance, and general purpose low-level data logging for contactless RFID cards. My contributions enable embedded emulation support for the common proprietary Mifare DESFire type NFC tags for use within the ChameleonMini (RevG) firmware.
  - 🌐 <https://github.com/emsec/ChameleonMini/blob/master/Doc/DESFireSupportReadme.md>
  - 🌐 <https://github.com/maxieds/ChameleonMiniDESFireStack>
  - 🌐 <https://github.com/emsec/ChameleonMini/pull/314> (see also: #286, #287, #319, #322, #323)
- **Homebrew Live Streamer:** A customizable, roll-your-own solution for live A/V recording to an Android phone device. It is also used with live media streaming to Facebook and YouTube for a transparent, free and open source application to perform the media streaming.
  - 🌐 <https://github.com/maxieds/HomeBrewLiveStreamer/wiki>
  - 🌐 <https://play.google.com/store/apps/details?id=com.maxieds.codenamepumpkinsconcert>
- **Mifare Classic Tool Library:** A Java and Android OS library wrapper around the functionality of the *Mifare Classic Tool* application for Android phones.
  - 🌐 <https://github.com/maxieds/MifareClassicToolLibrary>
  - 🌐 <https://github.com/maxieds/MCTLibraryDemo>
  - 🌐 <https://github.com/maxieds/ChameleonMiniUSBInterface>
  - 🌐 <https://github.com/maxieds/BreadCoSampleApp>
- **RNA and Mathematical Biology Project Build Scripts**
  - 🌐 <https://github.com/gtDMMB/homebrew-core>
  - 🌐 <https://github.com/gtDMMB/pmfe/tree/CustomBuildScriptMods-Summer2022-v1>

## Research

### Author Information

- Preprint Archive Listing: [https://arxiv.org/a/schmidt\\_m\\_2.html](https://arxiv.org/a/schmidt_m_2.html)
- OrcID Index: <https://orcid.org/0000-0002-3170-5535>

### Publications

- Schmidt, M. D. *Factorization theorems and canonical representations for generating functions of special sums*. Doctoral thesis at the Georgia Institute of Technology (2022).
  - 🌐 <https://arxiv.org/abs/2209.12287>
- Schmidt, M. D. *A recent open source embedded implementation of the DESFire specification designed for on-the-fly logging with NFC based systems*. In: Arai, K. (eds) Proceedings of the Future Technologies Conference (FTC) 2021, Volume 3 (2021).
  - 🌐 [https://doi.org/10.1007/978-3-030-89912-7\\_12](https://doi.org/10.1007/978-3-030-89912-7_12)
  - 🌐 <https://archive.org/embed/ftc2021-presentation-slides-with-notes>
- Schmidt, M. D., Kirkpatrick, A., and Heitch, C. *RNAStructViz: graphical base pairing analysis*. Bioinformatics 197 (2021).
  - 🌐 <https://doi.org/10.1101/2021.01.20.427505>
- Schmidt, M. D. *Exact formulas for the generalized sum-of-divisors functions*. Integers 21 A19 (2021).
- Mousavi, H. and Schmidt, M. D. *Factorization theorems for relatively prime divisor sums, GCD sums and generalized Ramanujan sums*. Ramanujan J. 54: 309–341 (2021).
  - 🌐 <http://doi.org/10.1007/s11139-020-00323-5>
- Schmidt, M. D. *Combinatorial sums and identities involving generalized divisor functions with bounded divisors*. Integers 20 A85 (2020).
- Merca, M. and Schmidt, M. D. *Factorization theorems for generalized Lambert series and applications*. Ramanujan J. 51: 391–419 (2020).
  - 🌐 <https://doi.org/10.1007/s11139-018-0095-7>
- Schmidt, M. D. *A short note on integral transformations and conversion formulas for sequence generating functions*. Axioms Special Issue on Mathematical Analysis and Applications II 8 2, 62 (2019).
  - 🌐 <https://doi.org/10.3390/axioms8020062>
- Merca, M. and Schmidt, M. D. *The partition function  $p(n)$  in terms of the classical Möbius function*. Ramanujan J. 49: 87–96 (2019).
- Merca, M. and Schmidt, M. D. *Generating special arithmetic functions by Lambert series factorizations*. Contrib. Discrete Math. 14 (1): 31–45 (2019).
- Schmidt, M. D. *Zeta series generating function transformations related to generalized Stirling numbers and partial sums of the Hurwitz zeta function*. Online J. Anal. Comb. 13 158. (2018).
- Schmidt, M. D. *New congruences and finite difference equations for generalized factorial functions*. Integers 18 A78 (2018).
- Schmidt, M. D. *Combinatorial identities for generalized Stirling numbers expanding  $f$ -factorial functions and the  $f$ -harmonic*

- numbers*. J. Integer Seq. 21 18.2.7 (2018).
- Schmidt, M. D. *Jacobi-type continued fractions and congruences for binomial coefficients modulo integers  $h \geq 2$* . Integers 18 A46 (2018).
  - Merca, M. and Schmidt, M. D. *A partition identity related to Stanley's theorem*. Amer. Math. Monthly 125 10: 929–933 (2018).  
 🔗 <https://doi.org/10.1080/00029890.2018.1521232>
  - Schmidt, M. D. *Continued Fractions for Square Series Generating Functions*. Ramanujan J. 46: 795–820 (2018).  
 🔗 <https://doi.org/10.1007/s11139-017-9971-9>
  - Schmidt, M. D. *New recurrence relations and matrix equations for arithmetic functions generated by Lambert series*. Acta Arith. 181 (2017): 355–367.  
 🔗 <http://doi.org/10.4064/aa170217-4-8>
  - Schmidt, M. D. *Continued fractions and  $q$ -series generating functions for the generalized sum-of-divisors functions*. J. Number Theory 180: 579–605 (2017).  
 🔗 <https://doi.org/10.1016/j.jnt.2017.05.023>
  - Schmidt, M. D. *Generating function transformations related to polylogarithm functions and the  $k$ -order harmonic numbers*. Online J. Anal. Comb. 12 2 (2017).
  - Schmidt, M. D. *Square series generating function transformations*. J. Inequal. Spec. Funct. 8 2 (2017).
  - Schmidt, M. D. *Jacobi-type continued fractions for the ordinary generating functions of generalized factorial functions*. J. Integer Seq. 20 17.3.4 (2017).
  - Schmidt, M. D. *A computer algebra package for polynomial sequence recognition*. Illinois IDEALS (2014).  
 🔗 <https://www.ideals.illinois.edu/handle/2142/49378>  
 🔗 <https://arxiv.org/abs/1609.07301> (most up-to-date version)
  - Schmidt, M. D. *Generalized  $j$ -factorial functions, polynomials, and applications*. J. Integer Seq. 13 10.6.7 (2010).

## Manuscripts.....

- Croot, E., Mousavi, H. and Schmidt, M. *On a conjecture of Graham on the  $p$ -divisibility of central binomial coefficients*. 2022.  
 🔗 <https://arxiv.org/abs/2201.11274>
- Schmidt, M. D. *Exact formulas for partial sums of the Möbius function expressed by partial sums weighted by the Liouville lambda function*. 2021.  
 🔗 <https://arxiv.org/abs/2102.05842>
- Schmidt, M. D. *A catalog of interesting and useful Lambert series identities*. 2020.  
 🔗 <https://arxiv.org/abs/2004.02976>
- Schmidt, M. D. *Georgia Tech Mathematics Comprehensive Exam Guide for Probability Theory*. 2020.  
 🔗 [https://archive.org/details/probability-gtmath-comprehensive-exam-notes-2020.03.18-v1\\_202203](https://archive.org/details/probability-gtmath-comprehensive-exam-notes-2020.03.18-v1_202203)
- Schmidt, M. D. *Georgia Tech Mathematics Comprehensive Exam Guide for Algebra*. 2019.  
 🔗 <https://archive.org/details/algebra-gtmath-comprehensive-exam-notes>
- Schmidt, M. D. *Georgia Tech Mathematics Comprehensive Exam Guide for Analysis*. 2018.  
 🔗 <https://archive.org/details/analysis-gtmath-comprehensive-exam-notes>
- Schmidt, M. D. *Pair correlation and gap distributions for substitution tilings and generalized Ulam sets in the plane*. 2017.  
 🔗 <https://arxiv.org/abs/1707.05509>
- Schmidt, M. D. *Factorization theorems for Hadamard products and higher-order derivatives of Lambert series generating functions*. 2017.  
 🔗 <https://arxiv.org/abs/1712.00608>
- Merca, M. and Schmidt, M. D. *New factor pairs for factorizations of Lambert series generating functions*. 2017.  
 🔗 <https://arxiv.org/abs/1706.02359>

## Conferences and Talks.....

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| AMS Joint Mathematical Meetings Special Session Invited Speaker    |      |
| MOBIUS ANT Number Theory Seminar at the University of Montreal     | 2022 |
| Georgia Tech Algebra Seminar Talk                                  | 2022 |
| AMS Fall Southeastern Sectional Meeting Invited Speaker            | 2021 |
| Integers Conference in Augusta                                     | 2019 |
| George Andrews 80 <sup>th</sup> Birthday Conference                | 2018 |
| Undergraduate Mathematics Seminar Talk at Georgia Tech             | 2018 |
| Association of Women in Mathematics Sponsored Talk at Georgia Tech | 2017 |
| Georgia Tech AMS Club Seminar                                      | 2017 |
| Young Mathematicians Conference at the Ohio State University       | 2017 |
|  | 2012 |